FINAL PROJECT MEMORANDUM

LIVE! POMPANO ISLE CASINO WATER SERVICE CAPACITY STUDY

KEITH AND ASSOCIATES, INC.

Date: February 9, 2022, Revised by Amendment 4/22/2022

Project No.: 200060.00

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Reviewed By:	Laura Baumberger, PE; Elizabeth Fujikawa, PE
Subject:	Water Service Capacity Study for Development by Keith and Associates in the City of Pompano Beach, FL – Findings and General Recommendations

Purpose

The purpose of this document is to transmit to Keith and Associates, Inc. (Client) general findings and recommendations for the future connection of The Cordish / El Dorado's platted development Live! Pompano Isle Casino to the City of Pompano Beach (City) potable water system, and their potential impact on the City's level of service and operation as related to pipe capacity and adequacy, and potable water service pressure. In order to issue recommendations, Carollo Engineers, Inc. (Carollo) used the City's potable water hydraulic model, developed in 2020 as part as the most recent Water Master Plan Update. It is Carollo's understanding that both the Client and the City will use recommendations provided herein to define service to the development, determine potential impacts to the timeline and/or nature of planned capital improvements to the area if needed, and identify further necessary related work.

Challenges and Definition of Scenarios

The development proposed by the Client is located in the City of Pompano Beach south of Race Track Road, or SW 3rd Street, and east of Powerline Road, as shown in Figure 1. The Live! Pompano Isle Casino proposed site currently has potable water service through three public supply accounts/meters. However, the majority of the area proposed for development does not currently have access to potable water distribution lines. The water utility service in the surrounding existing parcels is commercial and residential in nature. The existing commercial parcels shown to the south of Race Track Road/SW 3rd Street and north of N Cypress Bend Drive are subject to redevelopment as part of the project.

The City has recognized that, due to the criticality of the potable water transmission lines east and north of the area, and the large size of the proposed development, this development has the potential to influence supply, treatment, transmission, and distribution operations. Future plans to obtain additional water supply from alternative sources, and the availability of treatment capacity at the water treatment plant help eliminate uncertainty regarding the potential influence of the development on supply and treatment. This memorandum studies the potential impact on the remaining challenges – transmission and distribution.

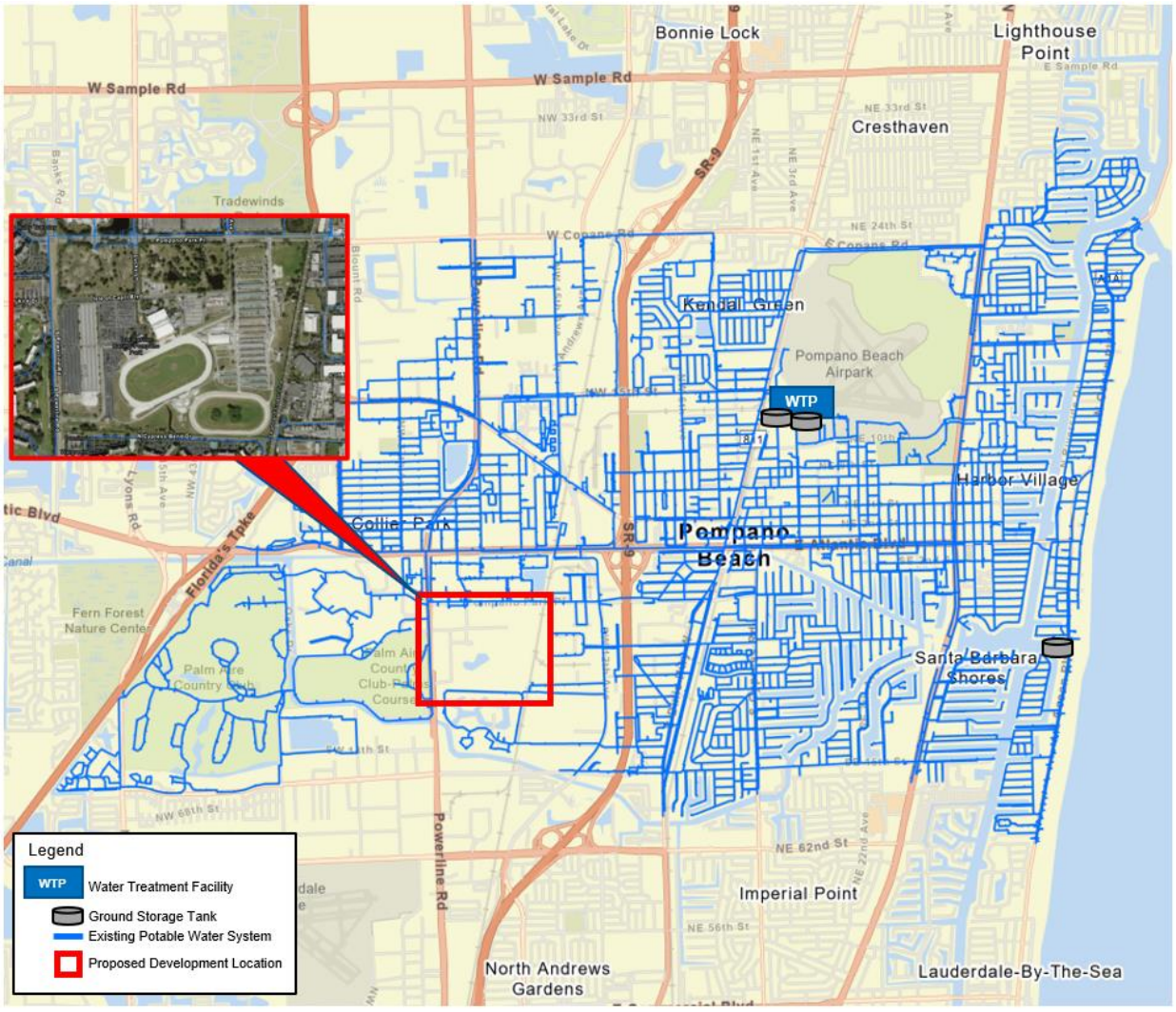

Figure 1 Location of Proposed Development by Client relative to City's Potable Water Distribution System

Carollo created scenarios in the City's potable water hydraulic model under average daily demand (ADD) and maximum day demand (MDD) conditions, without and with the development. The transmission and distribution system were then evaluated comparatively to determine and quantify the impact of the development on the City's potable water system. Scenarios used in this study include:

- Baseline Hydraulic Conditions
  - Projected 2025 ADD and MDD – without the proposed development
  - Projected 2040 ADD and MDD – without the proposed development
- Scenario 1 – Live! Casino Phase 1 development in 2025 (Phase 1)
  - 2025 ADD: 2025 demands with the addition of the Phase 1 development calculated demands under ADD conditions.
  - 2025 MDD: 2025 demands with the addition of the Phase 1 development calculated demands under MDD conditions.
- Scenario 2 – Live! Casino Phased development 2040 (Buildout)
  - 2040 ADD: 2040 demands with the addition of the calculated demands from the development during complete buildout under ADD conditions.
  - 2040 MDD: 2040 demands with the addition of the calculated demands from the development during complete buildout under MDD conditions.

Data and Assumptions

The City's potable water hydraulic model was modified to include pipes that were configured using a preliminary pipe layout and development plans provided by the Client. Demands and land use patterns were assigned to intersections between pipe segments, or junctions, based on proximity to buildings and land use type.

Carollo was provided with a phased development plan and corresponding calculated demands per phase. This data was evaluated for concurrency with City standards and applicable codes. When two standards provided different design demands, the higher unit demand was selected for conservatism.

Figure 2 shows the proposed pipe layout as included in the hydraulic model. Model junctions were placed in proximity of expected connections to the public utility pipes. Variable demands by phase were assigned to model junctions.

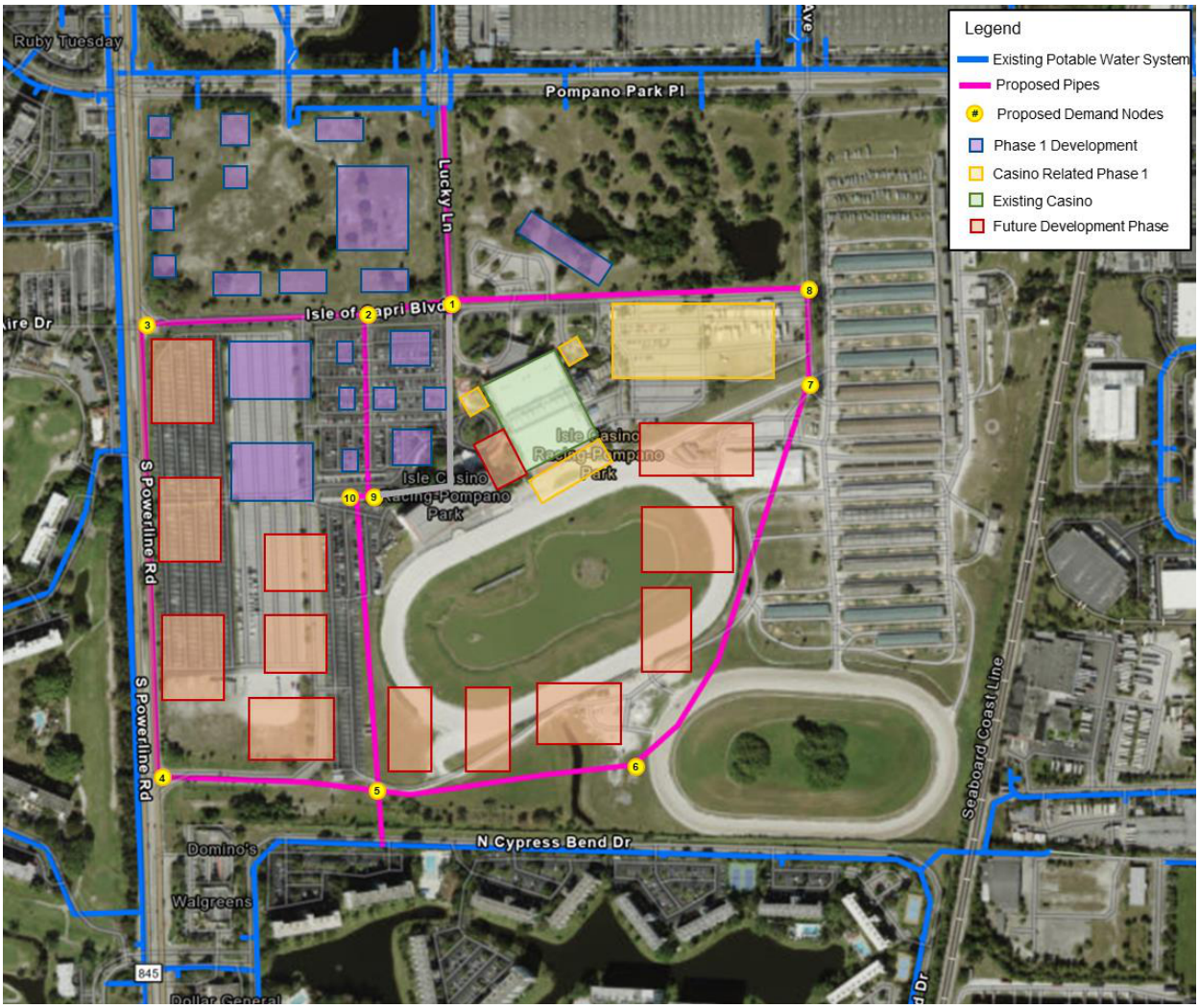

Figure 2 Developer Proposed Pipe Layout as Included in the Hydraulic Model

Table 1 shows the average water demands allocated to the corresponding junctions shown in Figure 2, for the Phase 1 and Buildout scenarios. Although junctions 4, 5, 6, and 7 do not have allocated demands in the Phase 1 scenario, simulations were performed with the entire piping loop in place. Water quality will be affected if a complete loop that connects the northern and the southern sides of the development with the public potable water distribution system is not built. The developer may add service lines to connect the different buildings to the main loop shown in Figure 2. The number of service lines departing from the main loop will not affect the results of this study if the total applied demand at the junctions shown is kept consistent.

Appendix A shows the proposed demands for each of the scenarios as listed originally by the Client and as amended by the Client upon further project refinement.

Table 1 Water Demands for the Live! Pompano Isle Casino Development

Assigned Junction[1]	Establishment	No. of Units[2]	Demand per Unit (gpd)	Demand (gpd)		Land Use[4]
				2025 Phase 1	2040 Buildout[3]	
1	Live! F&B (per seat)[5]	833.5	39	32,506.5	32,506.5	Institutional
	Casino Expansion (per SF)	5,500	0.38	2,090	2,090	General
	Existing Isle Casino Sub Meter #11059581	NA	Existing	19,765	19,765	General
	Grocery Store (per SF)[5]	48,387	1.25	60,484	60,484	General
	Top Golf	1	8778	8,778	8,778	General
	Industrial Development/Warehouse (per SF)	232,754	0.1	23,275.3	23,275.3	Industrial
	Jai Alai Fronton (per seat)	150	5	750	750	Institutional
2	Live! F&B (per seat)[5]	833.5	39	32,506.5	32,506.5	Institutional
3	Retail (per SF)	105,650	0.1	10,565	10,565	Commercial
	Recreation (per seat)	350	5	1,750	1,750	Institutional
	Residences #1[5]	450	270	-	121,500	Residential
4	Hotels (per room)[5]	250	161	-	40,250	Institutional
	Residences #1[5]	450	270	-	121,500	Residential
5	Residences #1[5]	450	270	-	121,500	Residential
	Residences #2[5]	600	270	-	162,000	Residential
6	Residences #2[5]	600	270	-	162,000	Residential
	Industrial Development/Warehouse (per SF)	232,754	0.1	23,275.3	23,275.3	Industrial
7	Residences #2[5]	600	270	-	162,000	Residential
	Industrial Development/Warehouse (per SF)	232,754	0.1	23,275.3	23,275.3	Industrial
8	Casino Expansion (per SF)	5,500	0.38	2,090	2,090	General
	Existing Isle Casino Sub Meter #11059581	NA	Existing	19,765	19,765	General

Assigned Junction[1]	Establishment	No. of Units[2]	Demand per Unit (gpd)	Demand (gpd)		Land Use[4]
				2025 Phase 1	2040 Buildout[3]	
	Parking Garage Office (per SF)	5,700	0.2	1,140	1,140	General
	Industrial Development/Warehouse (per SF)	232,754	0.1	23,275.3	23,275.3	Industrial
	Jai Alai Fronton (per seat)	150	5	750	750	Institutional
9	Hotels (per room) [5]	250	161	40,250	40,250	Institutional
	Hotels (per room)[5]	250	161	-	40,250	Institutional
10	Lagoon (per person)	500	10	5,000	5,000	General
	Parking Garage/Residential (per d.u.)[5]	500	270	135,000	135,000	Residential
	Residences #1[5]	450	270	-	121,500	Residential
	Total Demand (gpd)			**443,016**	**1,455,266**	

Notes:
(1) Refer to Figure 2 for location of junctions in the hydraulic model.
(2) Information provided by the Developer.
(3) Complete buildout of future development in year 2040.
(4) Land use type determined by Carollo based on establishment. Corresponding land use diurnal pattern (typical 24-hour demand fluctuation) used in model.
(5) Demand per unit based on City concurrency table.

This memorandum uses the data presented in Table 1 and demand data and infrastructure as found in the City's water hydraulic model previous to the development. A peaking factor of 1.41 is applied to calculate MDD from ADD, which corresponds to the City's MDD peaking factor as developed in the referenced Master Plan.

This memorandum summarizes the large-scale findings related to the hydraulic performance of incumbent infrastructure. Assessments provided are the result of desktop and engineering analyses, and not from condition assessments in the field. The computer model relies on available physical and operational data, understood to be the best available.

The pipe materials in this area according to the available GIS data are polyvinyl chloride (PVC) and cast iron pipe (CIP) which are assumed to have a Hazen-Williams C-factor of 150 and 130, respectively. This study does not include flow measurement. The existing total flow through transmission mains was sourced from the hydraulic model, based on existing water demand allocation which uses population projections and a per capita factor.

Transmission and distribution mains must be able to meet peak demands, which are assumed to occur at the highest point in a day with MDD conditions. The evaluations are based on performance criteria used in the City's latest Water Maser Plan to identify system deficiencies. Table 3 summarizes the performance criteria used to evaluate the scenarios.

Table 2 Performance Criteria for Hydraulic Modeling Evaluations

Parameter	ADD Scenario	MDD Scenario
Velocity	Less than or equal to 6 feet per second (fps)	Less than or equal to 7 fps.
Headloss	• Less than 3.5 feet per 1,000 feet for pipes 36 inches in diameter or larger. • Less than 5.5 feet per 1,000 feet for pipes with a diameter greater than or equal to 24 inches and less than 36 inches. • Less than 10 feet per 1,000 feet for pipes with a diameter less than 24 inches	
Junction Pressure	Greater than 50 pounds per square inch (psi) and less than 80 psi.	
Fire Flow Availability	Not applicable	Greater than the Need for Fire Flow (NFF) at critical sites, with uninterrupted domestic demand at a residual pressure of 20 psi

The ADD and MDD conditions are modeled using extended period simulation (EPS) scenarios. EPS (as opposed to steady state (SS) simulations) are used to evaluate 24-hour system response, and to assess the duration and severity of identified deficiencies.

Analyses

The impact of the Live! Pompano Isle Casino development on the potable water distribution system is summarized in this section by comparing the baseline hydraulic conditions (without the development) with the modified hydraulic conditions (with the development infrastructure and demand).

Baseline Hydraulic Conditions - System Analysis without the Infrastructure Proposed by the Developer

There are two scenarios considered as baseline hydraulic conditions: 1) Without the development and with 2025 City's demands (2025 Baseline Scenario), and 2) Without the development but with 2040 projected City demands (2040 Baseline Scenario).

2025 Baseline Scenario

This section presents the existing distribution system performance results without the development under 2025 ADD and MDD conditions. Parameters shown in Table 2 such as critical velocity in pipes, maximum headloss in pipes, and junction pressures were evaluated to identify non-compliant areas of the network. Results include:

Under ADD conditions:

- The majority of pipes throughout the system experience velocities lower than 6 fps, except suction and discharge headers of high service pumps. Velocity in the suction and discharge headers reach 22 fps during the highest average diurnal production, which occurs around 3 am, for storage tank filling. This is a normal velocity for the service that the headers provide.
- Junction pressures throughout the system meet the pressure performance criteria.
- Several distribution pipes may be reaching capacity within the system. The highest simulated velocity in distribution pipes during average daily demand conditions was 16 fps.
- All storage tanks are able to pump required flows and maintain normal tank levels under baseline ADD conditions.

- The water distribution system meets the selected performance criteria for the average day demand analysis.

Under MDD conditions:

- The majority of pipes throughout the system experience velocities lower than 7 fps. However, some pipes have velocities ranging from 7.28 to 20.9 fps. Most of these pipes are located directly downstream of the high service pumps.
- Junction pressures throughout the system meet the criteria.
- Only 0.06 percent of pipes in the network present a headloss in excess of the established criteria, and are short segments of 2-inch and 6-inch pipes, which are suspected to create hydraulic bottlenecks in the system. The 30-inch discharge header leaving the plant is beginning to show borderline high headlosses during the MDD baseline condition.
- All storage tanks can pump required flows and maintain normal tank levels under MDD conditions.
- The water distribution system meets the selected performance criteria for MDD.

2040 Baseline Scenario

This section includes distribution system performance with the City's 2040 projected demands without the development, under ADD and MDD. The system was evaluated to illustrate typical operating parameters without the inclusion of the development.

Under ADD conditions:

- The majority of pipes throughout the system experience velocities lower than 6 fps. No significant changes from the baseline ADD conditions are noted aside from pipes around the water treatment plant (WTP) and the Indian Mound remote pumping facility that are might be reaching capacity.
- Junction pressures throughout the system meet the pressure performance criteria.
- Several distribution pipes may be reaching capacity within the system. The highest simulated velocity in distribution pipes was 18 fps.
- All storage tanks can pump required flows and maintain normal tank levels.
- The water distribution system meets the selected performance criteria for the average day demand analysis.

Under MDD conditions:

- The majority of pipes throughout the system experience velocities lower than 7 fps. However, some pipes present velocities ranging from 7.62 to 21.8 fps. Most of these pipes are located directly downstream of the high service pumps and near the Indian Mound remote pump station.
- Junction pressures throughout the system meet performance criteria.
- Only 0.23 percent of pipes in the network present a headloss in excess of the established criteria. Such pipes are short segments of 2-inch and 6-inch diameters, which are suspected to create hydraulic bottlenecks in the system. The 30-inch discharge header leaving the plant is experiencing high headlosses during the 2040 baseline MDD condition.
- All storage tanks can pump required flows and maintain normal water levels.
- The water distribution system meets the selected performance criteria.

System Analysis with the Addition of Infrastructure Proposed by the Developer

This section describes the results of the simulations with the inclusion of the Live! Pompano Isle Casino development under ADD and MDD conditions. The proposed pipes are PVC material and range in size from 8- to 12-inches in diameter. The pipe that connects to the existing pipe along Race Track Road/SW 3rd Street in the northern side of the development is a 12-inch pipe and the pipe that connects to the existing line along N. Cypress Bend Drive in the southern side of the development is a 12-inch diameter pipe as well. All other pipes, including the loop, consist of 8-inch pipes throughout, and connect with the 12-inch pipes both at the northern and southern sides of the loop. Figure 3 shows the pipe diameters used in the simulations to meet the hydraulic performance criteria within the development.

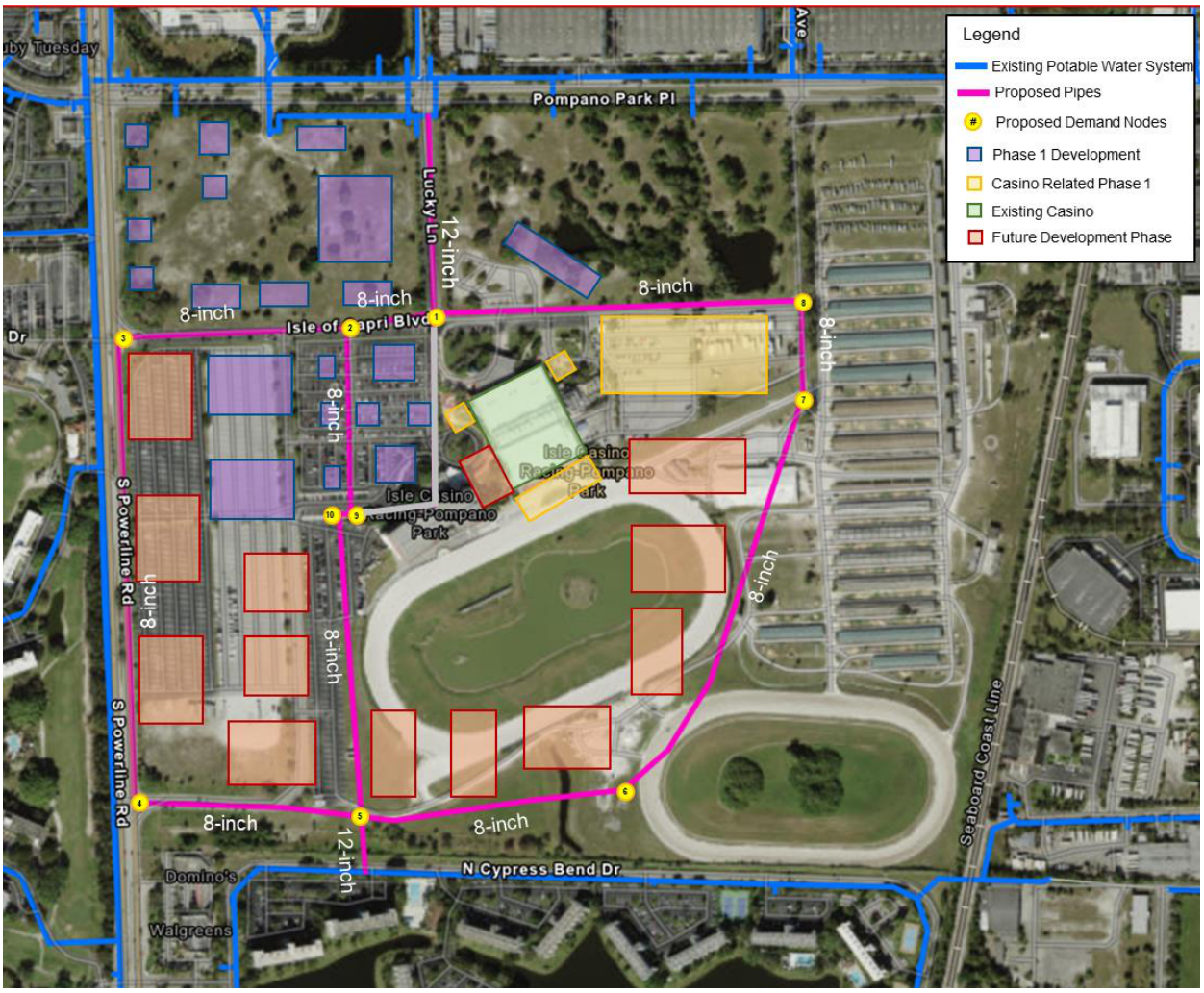

Figure 3 Proposed Water Infrastructure for the Development and Minimum Pipe Diameters Resulting from the Study.

Scenario 1 – Live! Casino Phase 1 Development in 2025 (Phase 1)

The Phase 1 scenario includes the demands proposed by the developer, allocated in the model per Table 1, and the 2025 projected ADD in the remainder of the City service area. A peaking factor of 1.41 is applied to all demands to simulate MDD conditions.

Under Phase 1 ADD conditions:

- With the exception of a few pipes near the discharge of the high service pumps where the highest simulated velocity in distribution pipes was 17.6 fps, system velocities are lower than 6 fps. The pipes around the Indian Mound tank and pump station briefly experience high velocities. Overall, demand conveyance capacity is nearly unaffected by the Phase 1 development during ADD conditions.
- Junction pressures throughout the system range from 55 psi to 79 psi. This means that the level of service relative to water service pressure will meet the performance criteria in an average day, even with the development in place, by 2025.

Under Phase 1 MDD conditions:

- The majority of pipes throughout the system experience velocities lower than 7 fps.
- Junction pressures throughout the system meet the criteria.

Figures 4 through 6 show localized comparisons of the critical flow velocity, maximum headloss in pipes, and minimum junction pressure, respectively, without and with the proposed development in 2025 under MDD conditions. The following is highlighted in these figures:

- Pipe velocities remain the same without and with the development aside from slight increases in pipes that were already reaching capacity. Increased velocities are experienced near the Indian Mound tank and pump station area, and directly southeast of the WTP. No marked increases in velocity are noted.
- There are only a few additional pipes that would not meet the headloss criterion.
- Minimum pressures decrease by less than 1 psi throughout the system. Decreases are noted in the southeast portion of the service area near the intracoastal waterway.

Tables in Appendices B and C include detail of the impact of the development in terms of the additional length of pipe that fall out of compliance for velocity and headloss, respectively, after the proposed phased construction and connection to the potable water distribution system. The tables identify the pipes of concern and location within the distribution system in 2025 and in 2040.

Legend

Maximum Velocity (ft/sec)
- Less than 2
- 2.01 - 7.00
- 7.01 - 10.00
- Greater than 10
- WTP Water Treatment Plant
- Ground Storage Tank
- Utility Service Area
- Lauderdale-By-The-Sea
- Lighthouse Point
- Pompano Beach
- Proposed Development Area

Miles
0 0.5 1

Data Sources: Broward County Cities GIS database, City of Pompano Beach GIS, Potable Water Hydraulic Model

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

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2025 Baseline

2025 Phase 1

Proposed Development Area

Lakeview
Bonnie Lock
Lighthouse Point
Cresthaven
Coconut Creek
Wynmoor Golf Club
Tam Oshanter Golf Club
Isle Casino Racing-Pompano Park
Palm Aire Country Club-Palms Course
Pompano Beach Airpark
Fern Forest Nature Center
Fort Lauderdale Executive Airport
Imperial Point
North Andrews Gardens
Lauderdale-By-The-Sea
Santa Barbara Shores
Lyons Rd
Banks Rd
Blount Rd
S Military Trl
SW 10th St
SW 15th St
NE 51st St
NE 48th St
NE 44th St
NE 15th Ave
NE 1st Ave
NE 3rd Ave
W Sample Rd
NW 33rd St
NW 68th St
NW 31st Ave
NE 62nd St
SR-9
Johnson Rd
W Hillsboro Blvd
Pompano Park Pl
WTP

Figure 4 Maximum Velocity - Baseline vs. Phase 1, 2025 Maximum Day Demand Condition

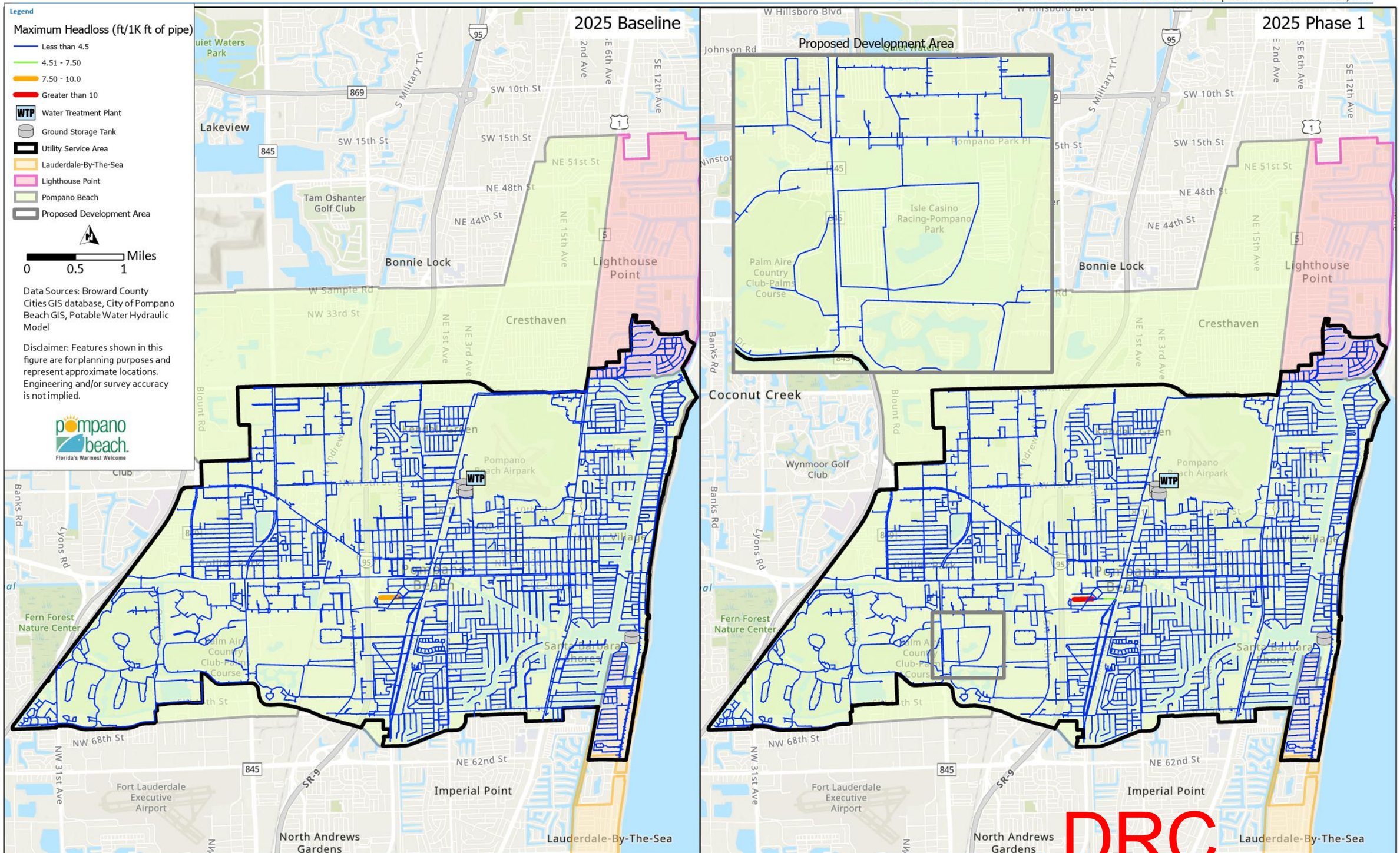

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Figure 5 Maximum Headloss - Baseline vs. Phase 1, 2025 Maximum Day Demand Condition

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Legend

Minimum Pressure (psi)
- Less than 20
- 20.01 - 50.00
- 50.01 - 65.00
- 65.01 - 80.00
- Greater than 80
- Distribution Network
- WTP Water Treatment Plant
- Ground Storage Tank
- Utility Service Area
- Lauderdale-By-The-Sea
- Lighthouse Point
- Pompano Beach
- Proposed Development Area

Miles
0 0.5 1

Data Sources: Broward County Cities GIS database, City of Pompano Beach GIS, Potable Water Hydraulic Model

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2025 Baseline

2025 Phase 1

Proposed Development Area

Lakeview
Tam Oshanter Golf Club
Bonnie Lock
Lighthouse Point
Cresthaven
Coconut Creek
Wynmoor Golf Club
Isle Casino Racing-Pompano Park
Palm Aire Country Club-Palms Course
Pompano Beach Airpark
Fern Forest Nature Center
Fort Lauderdale Executive Airport
Imperial Point
North Andrews Gardens
Lauderdale-By-The-Sea
Santa Barbara Shores
Quiet Waters Park
Johnson Rd
W Hillsboro Blvd
Pompano Park Pl
W Sample Rd
NW 33rd St
NW 68th St
NE 62nd St
SW 10th St
SW 15th St
NE 51st St
NE 48th St
NE 44th St
S Military Trl
SE 12th Ave
SE 6th Ave
NE 2nd Ave
NE 15th Ave
NE 3rd Ave
NE 1st Ave
NW 31st Ave
Banks Rd
Blount Rd
Lyons Rd
WTP
95
869
845
1
5
SR-9

Figure 6 Minimum System Pressure - Baseline vs. Phase 1, 2025 Maximum Day Demand Condition

Scenario 2 – Live! Casino Phased Development in 2040 (Buildout)

The 2040 Buildout scenario includes the allocated demands for the development at buildout, as listed in Table 1, along with the City's ADD demands projected in 2040. The peaking factor of 1.41 is applied to all demands under MDD conditions.

Under 2040 Buildout ADD conditions:

- Several distribution pipes are reaching capacity within the system. The highest simulated velocity in distribution pipes during average daily demand conditions was 18.0 fps.
- Junction pressures range from 55 psi to 79 psi.

Under 2040 Buildout MDD conditions:

Simulations support a change of pumping operations at the plant, which includes the operation of a previously stand-by pump (HSP3) in order to fill tanks, meet the peak system demands, and comply with the performance criteria and therefore the standard level of service. After this change, it is observed that:

- A few additional pipes do not comply with the headloss criterion during MDD conditions by 2040.
- The majority of pipes throughout the system experience velocities lower than 7 fps. The few exceptions range from 7.38 to 21.8 fps and are located at large distribution mains directly downstream of HSPs. Some smaller diameter pipes throughout the distribution system are reaching capacity in this scenario as well.
- Junction pressures throughout the system meet the pressure criteria.

Figures 7 through 9 show localized comparisons of the critical flow velocity, maximum headloss in pipes, and minimum junction pressure, respectively, without and with the proposed development for the buildout year, 2040, under MDD conditions. The following is highlighted in these figures:

- Pipe velocities increase slightly in the main distribution pipes directly downstream of the plant and near the Indian Mound tank and pump station when comparing the service area without and with the development at buildout.
- There are only a few additional pipes that would not meet the headloss criterion.
- Pressure decreases of 1 to 2 psi are experienced from the southeast portion moving northward along the intracoastal waterway. Pressures in the development show pressure decreases of 1 to 2 psi as well, but still meet the criteria. The areas surrounding the development show no significant pressure changes.

Tables in Appendices B and C include detailed tables that show the impact of the development in terms of the additional pipes that fall out of compliance for velocity and headloss, respectively, after the proposed construction and connection to the potable water distribution system at buildout. The tables identify the pipes of concern and location within the distribution system.

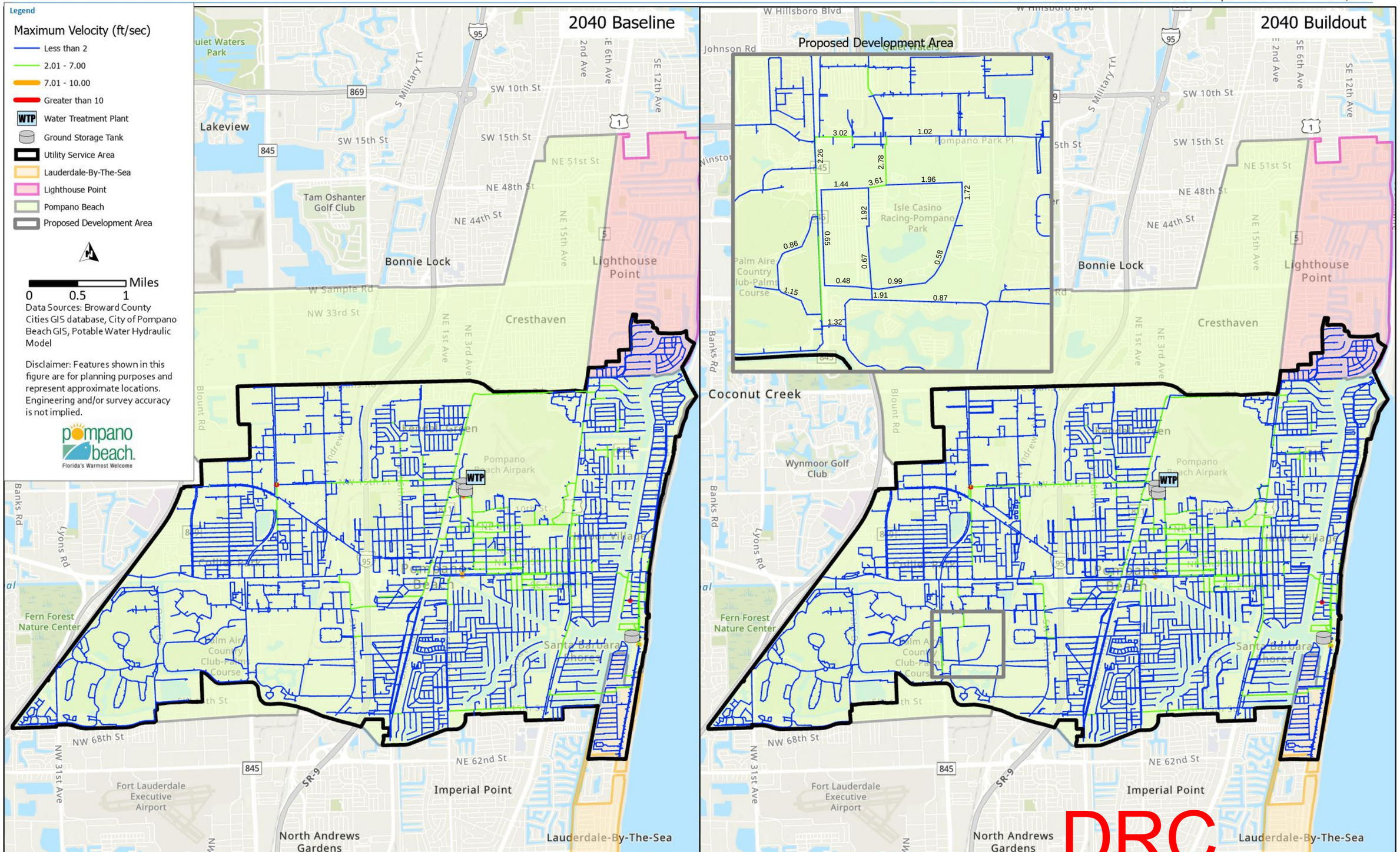

Figure 7 Maximum Velocity - Baseline vs. Buildout, 2040 Maximum Day Demand Condition

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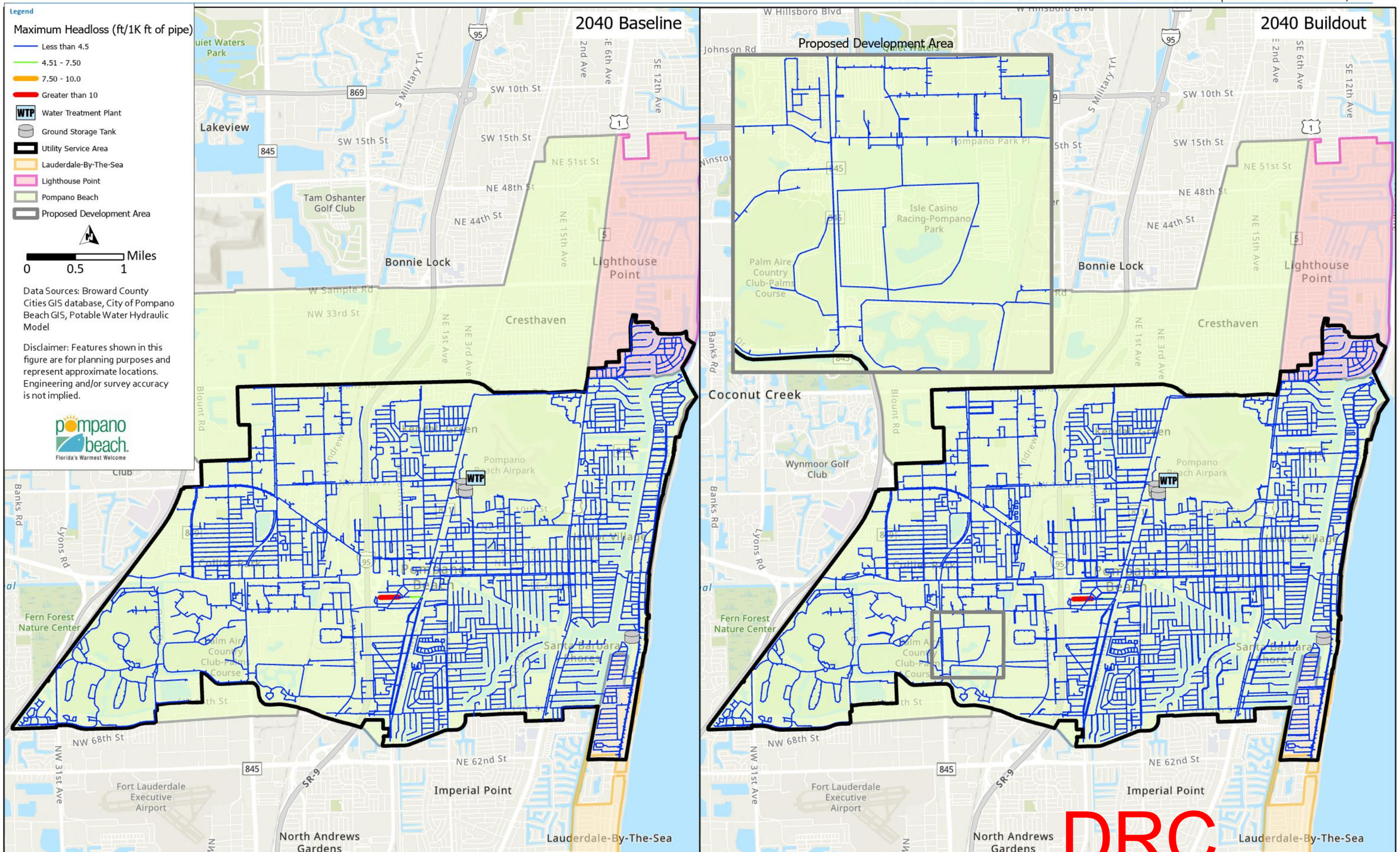

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Figure 8 Maximum Headloss - Baseline vs. Buildout, 2040 Maximum Day Demand Condition

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Legend

Minimum Pressure (psi)
- Less than 20
- 20.01 - 50.00
- 50.01 - 65.00
- 65.01 - 80.00
- Greater than 80

Distribution Network
WTP Water Treatment Plant
Ground Storage Tank
Utility Service Area
Lauderdale-By-The-Sea
Lighthouse Point
Pompano Beach
Proposed Development Area

Miles
0 0.5 1

Data Sources: Broward County Cities GIS database, City of Pompano Beach GIS, Potable Water Hydraulic Model

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2040 Baseline

2040 Buildout

Proposed Development Area

Figure 9 Minimum System Pressure - Baseline vs. Buildout, 2040 Maximum Day Demand Condition

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Fire Flow Availability

Fire flow 2025 and 2040 scenarios were simulated for the most critical Need for Fire Flow (NFF) expected within and around the Isle Casino development to establish fire flow requirement compliance. Model scenario runs are performed using the fire flow criteria set forth in Table 2.

Methodology and Assumptions

If a limiting factor for firefighting is identified for the most critical location, then the procedure would call for the investigation of other less critical demands and locations in the analysis. If no limiting factors for firefighting are identified for the most critical node, it is safe to assume that less critical fire nodes will attain their required firefighting flow need.

Fire flow scenarios were assumed to occur at maximum day demands, but not at peak hour. Therefore, fire flows were added to the base maximum day demands for the fire flow verification scenarios.

This same methodology was employed in the City of Pompano Beach Water Master Plan fire flow analyses.

Fire Flows

The most critical NFF within and around the development will be served from a node at the easternmost boundary of the pipe loop, as shown in Figure 10. A fire hydrant service line for a neighboring industrial development (a mail sorting facility) will tap into the Isle Casino main loop as shown. Such demand will be of a magnitude of 3,000 gpm. Data in Appendix A indicates that the second most critical fire flow demand will be 1,500 gpm, located at a future parking garage within the Isle Casino development.

Fire Flow Simulation Results

Table 3 shows results where scenarios are run first using a 6-inch diameter service line to the critical fire hydrant. The resulting flow availability under both 2025 and 2040 MDD scenarios is lower than the 3,000 gpm NFF identified by the developer. The scenarios were run a second time to avoid the pipe size limitation. An 8-inch fire hydrant service line from the loop to the critical location shown in Figure 10 would provide fire flow compliance given that the available fire flow would be greater than 3,000 gpm.

It should be noted that this analysis is valid only if the main Isle Casino pipe loop (8-inch pipe) is interconnected with the 12-inch incoming lines at intersections shown in Figure 10. As an example, if the 8-inch pipe in the southern part of the loop is not physically connected with the 12-inch line that comes north from N. Cypress Bend Drive, then a reduction in fire flow availability of approximately 20 percent is expected. Such reduction in fire flow availability can hinder firefighting capabilities.

Table 3 Fire Flow Availability and Limiting Factor at the Most Critical Node (NFF = 3,000 gpm)

Diameter of Fire Hydrant Service Pipe	Available Fire Flow (gpm) 2025 MMD Scenario	Available Fire Flow (gpm) 2040 MMD Scenario
6-inch	2,953 gpm	2,770 gpm
8-inch	3,696 gpm	3,430 gpm

Given that all the proposed water distribution pipes within the Isle Casino development are greater than 6-inch in diameter, and that fire flow availability has been confirmed for a 3,000 gpm NFF, all other proposed fire needs as identified in Appendix A will be met.

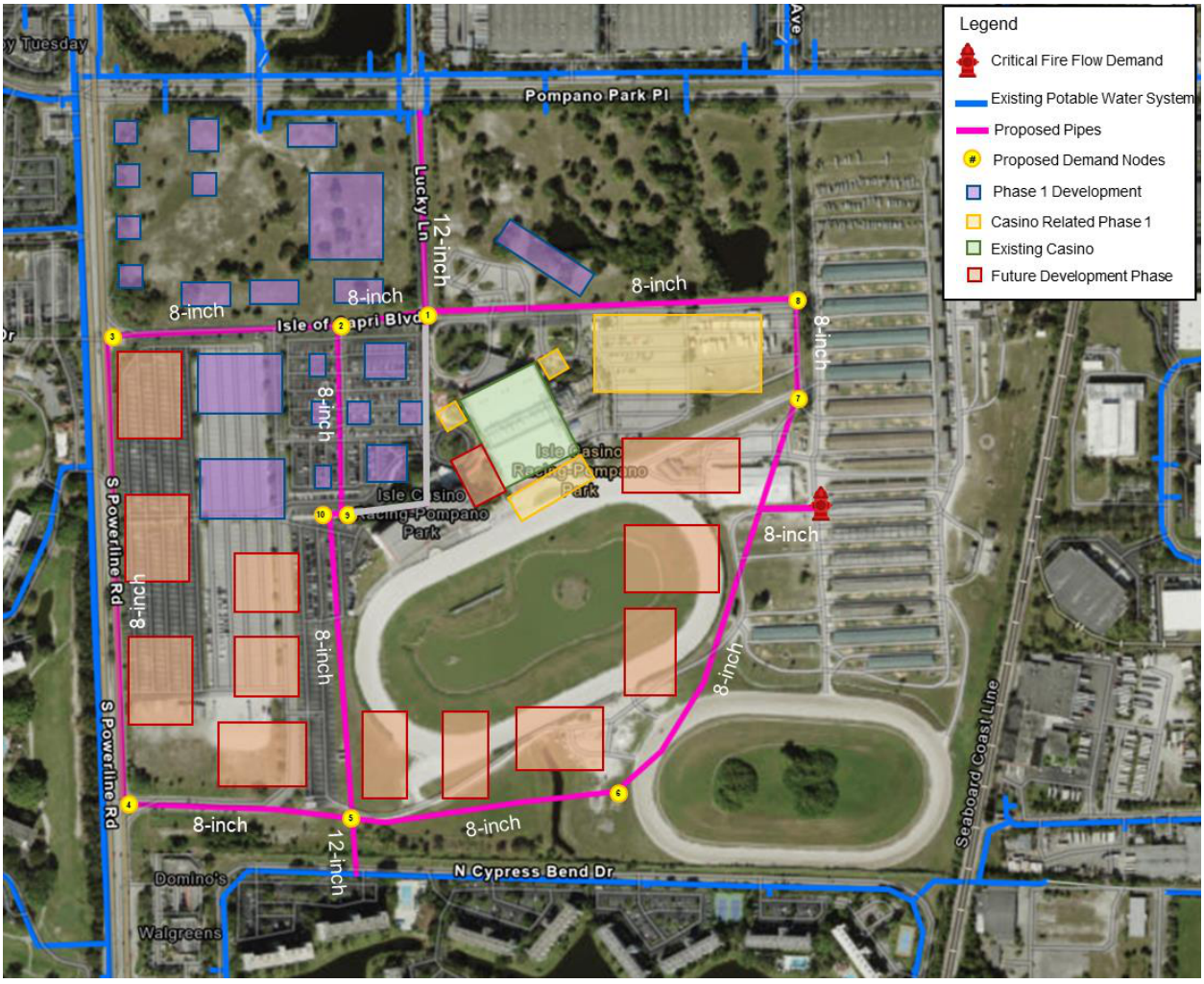

Figure 10 Proposed Location of the Most Critical Fire Flow Demand within the Development.

Conclusion and Recommendations

The addition of the Live! Pompano Isle Casino development has minimal impact to the current system and neighboring communities. This is summarized in Table 4 in terms of the performance criteria.

Table 4 Summary of Hydraulic Results With and Without the Addition of the Development

Analysis	Parameter	MDD Without the Development	MDD With the Development	Engineer Observation
Without the Development				
Phase 1	Velocity	0.01% of pipes do not meet criterion.	0.06% of pipes do not meet criterion.	0.05% more pipes exceed the velocity criterion as compared to the baseline scenario. Deficiencies stay localized at headers near or around HSPs by the WTP and Indian Mound remote pump station.
	Headloss	0.05% of pipes do not meet criterion.	0.18% of pipes do not meet criterion.	0.13% more pipes exceed the headloss criterion as compared to the baseline scenario. Deficiencies are at small diameter pipes throughout the system that create bottlenecks.
	Pressure	Pressures between 55 and 79 psi.		No impacts observed.
	Fire Flow Availability	Greater than NFF at critical sites, with uninterrupted domestic demand at a residual pressure of 20 psi		Compliant
Buildout Phase	Velocity	0.06% of pipes do not meet criterion.	0.07% of pipes do not meet criterion.	Standby pump HSP3 at the WTP must be turned on to meet system demands with the development. A few more pipes, mostly near or around HSPs by the WTP and Indian Mound pump station, are noted to reach capacity compared to 2040 Baseline.
	Headloss	0.23% of pipes do not meet criterion.	0.23% of pipes do not meet criterion.	No significant difference noted from 2040 Baseline.
	Pressure	Between 55 and 79 psi.	Between 55 and 78 psi.	Standby pump HSP3 at the WTP must be turned on to meet minimum system pressure with the development. Slight decrease in pressures are seen near Indian Mound and intracoastal waterway in southeastern portion of service area.
	Fire Flow Availability	Greater than NFF at critical sites, with uninterrupted domestic demand at a residual pressure of 20 psi		Compliant

Overall, the Isle Casino Development does not substantially impact the City's water system. In addition, neighboring communities directly surrounding the development show no signs of impact if the developer maintains the diameters shown in Figure 3 and the demand distribution as presented in Table 1. The potable water distribution system will be capable to provide firefighting flow to the area, and the infrastructure proposed by the developer as shown in this memorandum will be capable to serve the most critical need for fire flow that has been identified by the developer.

The impact, even though small and less significant in the long term, is quantifiable. Such impact is measured by means of comparing the infrastructure that was out of compliance with the performance criteria before the addition of the development (as documented in the City of Pompano Beach 2020 Master Plan), with the simulation outcome after the development. Comparative Figures 7 through 9 and tables in Appendices B and C show the deficiencies identified in the baseline hydraulic condition (without the development) vs. the deficiencies identified after the development. The difference among these two conditions may be attributed to the development and its demand on the system. The following is true from Figures 7 through 9 and tables in Appendices B and C:

- Near-term diminished hydraulic performance of transmission lines near the discharge of the high service pump station of the WTP (which had been identified before) will slightly worsen due to the increase in demand.
- High headloss and velocity are seen in some pipes with small diameters throughout the system; however, similar results were seen in the City's 2020 Water Master Plan.

Recommendations to eliminate the impact include:

The list of potential Capital Improvements Plan projects in the City's Water Master Plan could be expanded to include the few additional pipes impacted by the Isle Casino development in the long term.

With some operational adjustments, such as turning on an additional HSP during future MDD conditions and monitoring pressures to adjust filling of the Indian Mound tank, the system will be able to maintain and account for the additional demands in the long term.

It is recommended that the development stay true to their land use type as WTP pumping and storage operations are highly dependent on land use type patterns. Additional analyses to configure WTP pump station and storage tank operations will be needed for MDD conditions as future growth progresses. The Indian Mound facility in the east portion of the service area should be monitored as well since results show impact of the increased demand due to the development on this facility's pipe capacity in future scenarios.

Appendix A

DEMANDS PROPOSED BY DEVELOPER

Original and Amended

KEITH

LIVE! Resorts Pompano
Keith Project No. 10230.09
Date:05/13/2021

Estimated Master Water Demand

Proposed Water Demand - Years 0-5

Establishment	# Units	Per Unit gal/day		gal/day
Hotels (per room)	250	150	*	37,500
Retail (0.1 gpd / sq. ft.)	105,650	0.1	**	10,565
LIVE! F&B (30 gpd / seat)	1,667	30	*	50,010
Lagoon (10 gpd / person)	500	10	**	5,000
Existing Isle Casino Sub Meter #11059581	N/A	Existing	***	39,530
Casino Expansion (sq. ft.)	11,000	0.38	***	4,180
Jai Alai Fronton (5 gpd / seat)	300	5	*	1,500
Recreation (5 gpd / seat)	350	5	*	1,750
Grocery Store (0.1 gpd / sq. ft.)	48,387	0.1	**	4,839
Top Golf	1	8778	****	8,778
Parking Garage Office (0.2 gpd / sq. ft.)	5,700	0.2	*	1,140
Industrial Development/Warehouse(0.1 gpd / sq. ft.)	698,262	0.1	*	69,826
Parking Garage/Residential (per dwelling unit)	500	250	*	125,000
Total Estimated Daily Volume				**359,618**

Proposed Water Demand - Years 5-10

Establishment	# Units	Per Unit gal/day	gal/day
Residences - multiple family (per dwelling unit)	1,800	250 *	450,000
Total Estimated Daily Volume			**450,000**

Proposed Water Demand - Years 10-15

Establishment	# Units	Per Unit gal/day	gal/day
Residences - multiple family (per dwelling unit)	1,800	250 *	450,000
Hotels (per room)	225	150 *	33,750
Total Estimated Daily Volume			**483,750**

References:
* Broward County Code of Ordinances, Chapter 27, Section 27-201
** Florida Administrative Code Chapter 64E-6
*** City of Pompano Beach Water Meter Readings
**** Per Information Provided by TopGolf

DRC
PZ23-12000039
11/01/2023

From: Martin Grinbank <MGrinbank@keithteam.com>
Sent: Wednesday, January 5, 2022 1:49 PM
To: Angelica Gregory
Cc: Stephen Williams, Sr.
Subject: FW: LIVE! Resorts Pompano (KEITH 10230.09)

Angelica, we have not yet heard from you. We received the information below from the Developer of the industrial parcel with relation to the required fire flow demand:

Delivery Station: 1,250 gpm at the pump
Sortation Facility: 3,000 gpm at the pump

Please incorporate into your study.

Please let me know if you have any questions or if you need any additional information.

Regards,

Martin Grinbank
Project Manager II
Office: 954.788.3400
Email: MGrinbank@keithteam.com
www.KEITHteam.com

LIVE! Resorts Pompano
KEITH Project No. 10230.00
Fire Demand Calculations

Building #	Fire Demand
Building 1	1,250 GPM
Building 2	1,000 GPM
Building 3	1,000 GPM
Building 4	1,000 GPM
Building 5	1,000 GPM
Building 6	1,000 GPM
Building 7	1,000 GPM
Building 8	1,000 GPM
Building 9	1,000 GPM
Building 10	1,000 GPM
Building 11	1,000 GPM
Building 12	1,000 GPM
Building 13	1,000 GPM
Building 14	1,000 GPM
Building 15	1,125 GPM
Building 16	1,000 GPM
Building 17	1,565 GPM
Building 18	1,625 GPM
Building 19	N/A
Building 20	1,440 GPM
Building 21	1,440 GPM
Building 22	1,315 GPM
Building 23	1,500 GPM
Building 24	1,440 GPM
Building 25	1,500 GPM
Building 26	1,125 GPM
Building 27	1,125 GPM
Building 28	1,250 GPM
Building 29	1,190 GPM
Building 30	1,190 GPM
Building 31	1,125 GPM
Exist. Casino	1,000 GPM
Parking Garage	1,500 GPM

From: Stephen Williams, Sr. <SWilliams@keithteam.com>

Sent: Thursday, April 14, 2022 12:41 PM

To: Angelica Gregory; Martin Grinbank; Juniper Marini

Subject: RE: LIVE! Resorts Pompano Master Development (KEITH 10230.09)

Attachments: 10230.09 - Master Water System Concept.pdf; LIVE! Program Assessment - SF and Counts.pdf; 10230.09 LIVE! Resorts Pompano Master Water Demand Calculations-NodeSplit.pdf

Angelica,
Thanks for the preliminary results.

The Live! Loop connects to the south, as we discussed yesterday. All the scenarios should be run with the LIVE! Loop connected to the 12" mains to the North and to the South and all the pipe intersections within the LIVE! Development connected (shift node 5 to the intersection of the central pipe run).

We looked at the node splits for the planned development and they need to be adjusted to match the proposed development. See the attached which shows the development and the node splits. See flow splits summary below:

	Nodes									
	1	2	3	4	5	6	7	8	9	
Flow Split - KEITH	**124,373**	**32,507**	**133,815**	**121,500**	**283,500**	**185,275**	**185,275**	**45,880**	**80,500**	**2**
Flow Split - Report	244771	136500	12315	283250	243000	243000	243000	4180	40250	
Difference	-120,398	-103,994	121,500	-161,750	40,500	-57,725	-57,725	41,700	40,250	2

Table 1 Water Demands for the Live! Pompano Isle Casino Development

Assigned Junction[1]	Establishment	No. of Units[2]	Demand per Unit (gpd)	Demand (gpd) 2025 Phase 1	Demand (gpd) 2040 Buildout[3]	Land Use[4]
1&2 even split	Live! F&B (per seat)[5]	1,667	39	65,013	65,013	Institutional
1& 8 even split	Existing Isle Casino Sub Meter #11059581	NA	Existing	39,530	39,530	General
	Grocery Store (per SF)[5]	48,387	1.25	60,484	60,484	General
1	Top Golf	1	8778	8,778	8,778	General
8	Parking Garage Office (per SF)	5,700	0.2	1,140	1,140	General
6,7&8 even split	Industrial Development/Warehouse (per SF)	698,262	0.1	69,826	69,826	Industrial
10	Parking Garage/Residential (per d.u.)[5]	500	270	135,000	135,000	Residential
~~2~~ 1& 8 even split	Jai Alai Fronton (per seat)	300	5	1,500	1,500	Institutional
3	Retail (per SF)	105,650	0.1	10,565	10,565	Commercial
	Recreation (per seat)	350	5	1,750	1,750	Institutional
~~4~~ 9	Hotels (per room)[5]	250	161	-	40,250	Institutional
3,4,5&10 even split 4 & 5[6]	Residences #1[5]	1,800	270	-	486,000	Residential
5,6,&7 even split 6 & 7[6]	Residences #2[5]	1,800	270	-	486,000	Residential
1& 8 even split 8	Casino Expansion (per SF)	11,000	0.38	4,180	4,180	General
9	Hotels (per room)[5]	250	161	40,250	40,250	Institutional
10	Lagoon (per person)	500	10	5,000	5,000	General
		Total Demand (gpd)		**443,016**	**1,455,266**	

Notes:

DRC

PZ23-12000039
11/01/2023

Figure 2 Developer Proposed Pipe Layout as Included in the Hydraulic Model

Please call me if you get a chance.

Take care,

KEITH

DRC

PZ23-12000039
11/01/2023

Appendix B

PIPES EXCEEDING VELOCITY CRITERIA

Table B-1 Pipeline Exceeding Velocity Criteria – Existing MDD vs. Phase 1 MDD Conditions

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Maximum Velocity (fps)
Pipes Exceeding Velocity Criterion – Existing MDD Conditions without the Development				
PW-PIP-61-9055	SE 13th Avenue and SE 2nd Street	26.77	6	20.9
PW-PIP-12-2895	Along Hibiscus Avenue and SE 6th Street	2.83	2	14.1
PW-PIP-104-7174	Southeast corner of NW 15th Street and N Powerline Road	13.94	12	13.4
PW-PIP-61-175	WTP HSP header downstream of HSP 1	10.87	30	9.47
PW-PIP-61-1233	WTP HSP header downstream of PW-PIP-61-175	17.07	30	9.47
PW-PIP-61-178	WTP HSP header downstream of PW-PIP-61-1233	27.82	30	9.47
PW-PIP-61-1133	NE 4th Avenue and E Atlantic Boulevard	16.79	6	8.27
PW-PIP-61-35		62.31	6	8.27
PW-PIP-61-1235	30-in transmission main downstream of the HSPs	16.11	30	7.28
PW-PIP-61-9696		16.15	30	7.28
Additional Pipes Exceeding Velocity Criterion – Phase 1 MDD Conditions with the Development				
PW-PIP-21-9883	Pipes leading to Indian Mound Tank to the east of Hibiscus Avenue.	101.7	12	11.4
PW-PIP-21-9884				
TO_INDIAN_MOUND_TANK				
PW-PIP-21-9878	Pipes to east of Hibiscus Avenue coming from Indian Mound Pump Station.	29.96	12	10.3
PW-PIP-21-9879				
PW-PIP-21-9880				
PW-PIP-21-9881				
PW-PIP-21-2742	Pipes leaving Indian Mound Pump Station heading south along Hibiscus Avenue and east along SE 13th Street.	650.8	12	8.60
PW-PIP-21-9891				
PW-PIP-21-9892				
INDIAN_MOUNT_TO_DISTRIBUTION_1				
PW-PIP-21-9882				

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Maximum Velocity (fps)
PW-PIP-21-2387	8-inch line connecting two 12-inch lines at the intersection S Ocean Boulevard just south of SE 13th Street.	30.54	8	7.68
PW-PIP-21-2970				
PW-PIP-61-176	WTP HSP header downstream of HSP 1 and HSP 2.	14.0	30	7.38
	Total Impacted Length of Pipe in Phase 1 Scenarios	**827**		

Table B-2 Pipeline Exceeding Velocity Criteria – 2040 Baseline MDD vs. 2040 Buildout MDD Conditions

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Maximum Velocity (fps)
Pipes Exceeding Velocity Criterion – 2040 Baseline MDD Conditions without the Development				
PW-PIP-61-9055	SE 13th Avenue and SE 2nd Street	26.77	6	21.8
PW-PIP-104-7174	Southeast corner of NW 15th Street and N Powerline Road	13.94	12	15.1
PW-PIP-12-2895	Along Hibiscus Avenue and SE 6th Street	2.83	2	14.1
PW-PIP-21-9883	Pipes leading to Indian Mound Tank to the east of Hibiscus Avenue.	50.58	12	11.3
PW-PIP-21-9884				
TO_INDIAN_MOUND_TANK				
PW-PIP-61-1233	WTP HSP header downstream of PW-PIP-61-175	17.07	30	10.6
PW-PIP-61-178	WTP HSP header downstream of PW-PIP-61-1233	27.82	30	10.6
PW-PIP-61-175	WTP HSP header downstream of HSP 1	10.87	30	10.6
PW-PIP-21-9878	Pipes to east of Hibiscus Avenue coming from Indian Mound Pump Station.	29.96	12	10.2
PW-PIP-21-9879				
PW-PIP-21-9880				
PW-PIP-21-9881				
PW-PIP-61-1133	NE 4th Avenue and E Atlantic Boulevard	79.10	6	9.68
PW-PIP-61-35				
PW-PIP-21-2742	Pipes leaving Indian Mound Pump Station heading south along Hibiscus Avenue and east along SE 13th Street.	650.8	12	8.55
PW-PIP-21-9891				
PW-PIP-21-9892				
INDIAN_MOUNT_TO_DISTRIBUTION_1				
PW-PIP-21-9882				
PW-PIP-61-176	WTP HSP header downstream of HSP 1 and HSP 2.	14	30	8.46
PW-PIP-61-1235	30-in transmission main downstream of the HSPs	32.26	30	8.12
PW-PIP-61-9696				

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Maximum Velocity (fps)
PW-PIP-21-2970	8-inch line connecting two 12-inch lines at the intersection S Ocean Boulevard just south of SE 13th Street.	30.54	8	7.62
PW-PIP-21-2387				
Additional Pipes Exceeding Velocity Criterion – 2040 MDD Conditions with the Development				
PW-PIP-61-1229	WTP HSP header downstream of HSP 3.	12	18	7.94
PW-PIP-61-170				
Total Additional Impacted Length of Pipe in 2040 Buildout Scenario		**12**		

Appendix C

PIPES EXCEEDING HEADLOSS CRITERIA

Table C-1 Pipelines Exceeding Headloss Criteria - Existing MDD vs. Phase 1 MDD Conditions

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Maximum Headloss per 1,000 ft (ft)
Pipes Exceeding Headloss Criterion – Existing MDD Conditions without the Development				
PW-PIP-12-2895	Along Hibiscus Avenue and SE 6th Street	2.83	2	318.46
PW-PIP-61-9055	Along SE 13th Avenue and SE 2nd Street	26.77	6	197.78
PW-PIP-61-8974	Along SE 17th Avenue, connecting to 6-in line along E Atlantic Boulevard	16.02	2	71.77
PW-PIP-61-9393_A	Along SE 17th Avenue connecting to a 6-in line in the south; south of PW-PIP-61-8974	26.1	2	71.77
PW-PIP-61-9393_B				
PW-PIP-90-6893	North of SW 2nd Court and SW Avondale Drive	107.55	2	56.62
PW-PIP-90-8010				
PW-PIP-90-12010				
PW-PIP-104-7174	Southeast corner of NW 15th Street and N Powerline Road	13.94	12	44.21
PW-PIP-61-1133	Along NE 4th Avenue and E Atlantic Boulevard	79.10	6	35.48
PW-PIP-61-35				35.02
PW-PIP-21-2791	Along Hibiscus Avenue, north of pipe PW-PIP-21-2260	305.2	6	22.35
PW-PIP-21-2260	Along Hibiscus Avenue, downstream and north of Indian Mound discharge	3.9	6	22.29
PW-PIP-21-2398_B	Along Hibiscus Avenue, north of pipe PW-PIP-21-2971	8.0	6	22.29
PW-PIP-21-2387	East along S Ocean Drive southeast of Indian Mound	8.39	8	20.44
PW-PIP-21-2970	East along S Ocean Drive southeast of Indian Mound; connects to PW-PIP-21-2387	22.15	8	20.44
PW-PIP-44-9169	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9497_2 in the north	6.5	2	18.02
PW-PIP-44-9497_1	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9497_4 in the south	66.0	2	18.02
PW-PIP-44-9497_2	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9169 in the south and pipe PW-PIP-44-9497_4 in the north	1.5	2	18.02

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Maximum Headloss per 1,000 ft (ft)
PW-PIP-44-9497_4	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9497_2in the south and pipe PW-PIP-44-9497_1 in the north	66.5	2	18.02
Additional Pipes Exceeding Headloss Criterion – Phase 1 MDD Conditions with the Development				
PW-PIP-21-9884	Pipes leading to Indian Mound Tank to the east of Hibiscus Avenue.	50.85	12	33.16
TO_INDIAN_MOUND_TANK				
PW-PIP-21-9883				
PW-PIP-21-9879	Pipes to east of Hibiscus Avenue coming from Indian Mound Pump Station.	29.96	12	21.83
PW-PIP-21-9880				
PW-PIP-21-9881				
PW-PIP-21-9878				
INDIAN_MOUNT_TO_DISTRIBUTION_1	Pipes leaving Indian Mound Pump Station heading south along Hibiscus Avenue and east along SE 13th Street.	7	12	18.62
PW-PIP-32-893	2-inch line connecting two 6-inch lines along NE 18th Street between NE 27th Avenue and NE 28th Avenue.	211.57	2	17.97
PW-PIP-61-121	Along NE 6th Street at the intersection of NE 5th Avenue.	35.25	6	16.40
PW-PIP-61-1190				
PW-PIP-21-2742	Pipe leaving Indian Mound Pump Station heading south along Hibiscus Avenue and east along SE 13th Street.	643.8	12	15.76
PW-PIP-21-9891				
PW-PIP-21-9892				
PW-PIP-21-9882				
PW-PIP-90-5411	2-inch line along SW 2nd Court crossing Avondale Drive.	1,034.18	2	15.76
PW-PIP-61-175	WTP HSP header downstream of HSP 1	55.76	30	7.69
PW-PIP-61-1233	WTP HSP header downstream of PW-PIP-61-175			
PW-PIP-61-178	WTP HSP header downstream of PW-PIP-61-1233			
Total Impacted Length of Pipe in Phase 1 Scenarios		**2,068.37**		

Table C-2 Pipelines Exceeding Headloss Criteria – 2040 Baseline MDD vs. 2040 Buildout MDD Conditions

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Max. Headloss per 1,000 ft (ft)
Pipes Exceeding Headloss Criterion – Existing MDD Conditions without the Development				
PW-PIP-12-2895	Along Hibiscus Avenue and SE 6th Street	2.83	2	316.3
PW-PIP-61-9055	Along SE 13th Avenue and SE 2nd Street	26.77	6	213.9
PW-PIP-61-8974	Along SE 17th Avenue, connecting to 6-in line along E Atlantic Boulevard	16.02	2	76.68
PW-PIP-61-9393_A	Along SE 17th Avenue connecting to a 6-in line in the south; south of PW-PIP-61-8974	26.10	2	76.68
PW-PIP-61-9393_B				
PW-PIP-90-6893	North of SW 2nd Court and SW Avondale Drive	107.55	2	78.68
PW-PIP-90-8010				
PW-PIP-90-12010				
PW-PIP-104-7174	Southeast corner of NW 15th Street and N Powerline Road	13.94	12	55.02
PW-PIP-61-1133	Along NE 4th Avenue and E Atlantic Boulevard	79.10	6	47.65
PW-PIP-61-35				
PW-PIP-21-9884	Pipes leading to Indian Mound Tank to the east of Hibiscus Avenue.	50.85	12	32.89
TO_INDIAN_MOUND_TANK				
PW-PIP-21-9883				
PW-PIP-21-2398_B	Along Hibiscus Avenue, north of pipe PW-PIP-21-2971	8.0	6	21.95
PW-PIP-21-2260	Along Hibiscus Avenue, downstream and north of Indian Mound discharge	3.9	6	21.89
PW-PIP-21-2791	Along Hibiscus Avenue, north of pipe PW-PIP-21-2260	305.2	6	21.89
PW-PIP-21-9879	Pipes to east of Hibiscus Avenue coming from Indian Mound Pump Station.	29.96	12	21.56
PW-PIP-21-9880				
PW-PIP-21-9881				
PW-PIP-21-9878				
PW-PIP-90-5411	2-inch line along SW 2nd Court crossing Avondale Drive.	1,034.18	2	20.12
PW-PIP-21-2387	East along S Ocean Drive southeast of Indian Mound	8.39	8	19.96

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Max. Headloss per 1,000 ft (ft)
PW-PIP-21-2970	East along S Ocean Drive southeast of Indian Mound; connects to PW-PIP-21-2387	22.15	8	19.96
PW-PIP-90-12013	2-inch line along SW 2nd Court just east of SW 4th Avenue.	17.06	2	19.07
INDIAN_MOUNT_TO_DISTRIBUTION_1	Pipes leaving Indian Mound Pump Station heading south along Hibiscus Avenue and east along SE 13th Street.	7	12	19.00
PW-PIP-61-121	Along NE 6th Street at the intersection of NE 5th Avenue.	16.61	6	18.31
PW-PIP-61-1190		18.64	6	18.07
PW-PIP-32-893	2-inch line connecting two 6-inch lines along NE 18th Street between NE 27th Avenue and NE 28th Avenue.	211.57	2	17.24
PW-PIP-90-12011	2-inch line along SW 2nd Court just east of SW 4th Avenue.	664.42	2	17.10
PW-PIP-90-6881				
PW-PIP-44-9169	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9497_2 in the north	6.5	2	17.06
PW-PIP-44-9497_1	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9497_4 in the south	66.0	2	17.06
PW-PIP-44-9497_2	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9169 in the south and pipe PW-PIP-44-9497_4 in the north	1.5	2	17.06
PW-PIP-44-9497_4	Between SE 13th Court and SE 13th Street; connects to pipe PW-PIP-44-9497_2in the south and pipe PW-PIP-44-9497_1 in the north	66.5	2	17.06
PW-PIP-21-2742	Pipe leaving Indian Mound Pump Station heading south along Hibiscus Avenue and east along SE 13th Street.	643.8	12	15.55
PW-PIP-21-9891				
PW-PIP-21-9892				
PW-PIP-21-9882				
PW-PIP-61-1233	WTP HSP header downstream of PW-PIP-61-175	17.07	30	8.67
PW-PIP-61-175	WTP HSP header downstream of HSP 1	10.87	30	8.67
PW-PIP-61-178	WTP HSP header downstream of PW-PIP-61-1233	27.82	30	8.67

Pipe GIS ID	Location	Length (ft)	Diameter (in)	Max. Headloss per 1,000 ft (ft)
Additional Pipes Exceeding Headloss Criterion – 2040 Buildout MDD Conditions with the Development				
PW-PIP-61-1229 PW-PIP-61-170	WTP HSP header downstream of HSP 3.	12	18	10.61
PW-PIP-61-176	WTP HSP header downstream of HSP 1 and HSP 2.	14	30	6.14
PW-PIP-61-1235 PW-PIP-61-9696	30-in transmission main downstream of the HSPs.	32.26	30	5.77
Total Additional Impacted Length of Pipe in 2040 Buildout Scenarios		**58.26**		